Vol. 38 No. 5

BULLETIN

OF THE

TORREY BOTANICAL CLUB

MAY, 1911

The Hepaticae of the Bahama Islands

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(WITH PLATES 9 AND 10)

Previous to 1903 no Hepaticae had been reported from the Bahama Islands. In that year a list of eight species was published by Coker* from determinations made by the writer. It was based on collections made in the vicinity of Nassau and includes six Lejeuneae and two species of *Frullania*. With a single exception the species listed are also known from Florida and all are common in the Antilles.

During the years 1904–1910 a botanical exploration of the Islands was carried on under the direction of the New York Botanical Garden. The collections made included many packets of Hepaticae and these also were sent to the writer for examination. They were found to contain twenty-six species which Coker did not list, thus raising the total number of species known from the Islands to thirty-four. Several Lejeuneae from these collections, including the new *Brachiolejeunea bahamensis*, have already been reported upon in other connections.

The most complete representation of Bahamian Hepaticae was secured by Mrs. Elizabeth G. Britton, who found twenty-six species on the island of New Providence alone. The other islands, only one of which was visited by Mrs. Britton, yielded much smaller collections, Andros leading with only eight species to its credit. It is of course probable that most of the forms now known from New Providence only are more or less widely distributed through-

*In Shattuck: The Bahaman Islands 248. 1905.

[The BULLETIN for April 1911 (**38**: 153–204. *pl. 2–8*) was issued 5 My 1911.]

out the group, and that others still await discovery. The collections already made, however, show clearly the general characteristics of the hepatic flora.

The present paper includes a full report on the various specimens studied by the writer. Under each species the local distribution in the archipelago is given, together with notes on the general distribution. New or otherwise noteworthy species are treated more fully than the others and, in conclusion, the relationships of the Bahamian Hepaticae to those of neighboring regions are briefly discussed. Since many of the Lejeuneae listed have recently been studied critically by the writer, references are given to papers in which descriptions of such species may be found. No attempt is made, however, to treat the synonymy at length.

RICCIACEAE

1. RICCIELLA CRYSTALLINA (L.) Warnst.

On wet ground. New Providence: Barnett's Point, *Britton & Millspaugh* (*2627*). Widely distributed in North America, Europe, and Asia.

MARCHANTIACEAE

2. MARCHANTIA CHENOPODA L.

Along a drain. New Providence: Fort Charlotte, *Brace* (*3916*). Widely distributed in the American tropics. The Bahamian specimens are gemmiparous and show neither male nor female receptacles.

JUNGERMANNIACEAE

3. PLAGIOCHILA LUDOVICIANA Sulliv.

On bark. New Providence: Maidenhead Coppice, *E. G. Britton* (*253*, *3221*, *6555*). Florida to Louisiana.

4. RADULA AUSTRALIS Aust.

On bark. Andros: Nicholl's Town and vicinity, *Brace* (*6880*). New Providence: Maidenhead Coppice, *E. G. Britton* (*3261 p.p.*). Georgia and Florida. Recently reported from the Bahama Islands by Stephani.*

*Species Hepat. 4: 216. 1910.

5. DIPLASIOLEJEUNEA RUDOLPHIANA Steph. Hedwigia **35**: 79. 1896.

On bark. New Providence: Soldiers Road, *Coker* (*1 p.p.*), *E. G. Britton* (*819 p.p., 820 p.p., 3255 p.p.*); Waterloo, *E. G. Britton* (*3 p.p.*); Rifle Range Coppice, *E. G. Britton* (*561 p.p.*); Lake Cunningham, *E. G. Britton* (*645 p.p.*); near Tea House, *E. G. Britton* (*3193 p.p.*). Florida; tropical America. Widely distributed but often confused with *D. unidentata* (Lehm. & Lindenb.) Schiffn. The species has already been listed under this name by Coker.

6. COLOLEJEUNEA JOORIANA (Aust.) Evans, Mem. Torrey Club **8**: 173. *pl. 22. f. 9–20.* 1902.

On bark. New Providence: Waterloo, *E. G. Britton* (*3 p.p.*). Crooked Island: Stopper Hill, *Brace* (*4816 p.p.*). North Carolina to Florida and Louisiana; Bermuda.

7. LEJEUNEA FLAVA (Swartz) Nees, Naturgesch. Eur. Leberm. **3**: 277. 1838.

Jungermannia flava Swartz, Prodr. Fl. Ind. Occ. 144. 1788.
Lejeunea Moorei Lindb. Acta Soc. Sc. Fenn. **10**: 487. 1875.
Lejeunea americana (Lindb.) Evans, Mem. Torrey Club **8**: 154. *pl. 20. f. 14–26.* 1902.*

On bark. New Providence: Waterloo, *E. G. Britton* (*765 p.p.*); Maidenhead Coppice, *E. G. Britton* (*6576 p.p.*). Widely distributed in tropical regions throughout the world; Ireland; Australia; North Carolina to Florida and westward to Texas.

A specimen of *Lejeunea flava* collected by Swartz in Jamaica is preserved in the herbarium of the British Museum and is doubtless to be considered a part of the original material. It agrees closely with the plants from various North American localities, which the writer has lately referred to *L. americana*. The latter species, therefore, as indicated above, must be reduced to synonymy. The specimens distributed in Hepaticae Spruceanae under the name *Eulejeunea flava* present a somewhat different appearance, but they are not very well preserved and can hardly give a clear idea of Spruce's interpretation of the species. In

*Schiffner gives other synonyms in his Conspectus Hepaticarum Archipelagi Indici 249. 1898.

any case the epiphyllous plants which he described and distributed under the name *Eulejeunea albida* agree with Florida specimens of *L. flava* and therefore with Swartz's Jamaican specimens. It may be noted in this connection that the original material of *L. flava* was also epiphyllous, growing on the old leaves of ferns; the species, however, is even more common on bark.

8. LEJEUNEA GLAUCESCENS Gottsche.

On bark. Great Bahama: Eight Mile Rocks, *Britton & Millspaugh* (*2587*, *2609*). Cat Island: the Bight and vicinity, *Britton & Millspaugh* (*5872*, *5873*). Tropical America; Florida; Bermuda. The Bahamian specimens are not very well developed but seem to be referable to this species.

9. MICROLEJEUNEA BULLATA (Tayl.) Evans, Mem. Torrey Club **8**: 164. *pl. 21. f. 20–29.* 1902.

On bark. New Providence: Soldiers Road, *Coker* (*15 p.p.*); Waterloo, *E. G. Britton* (*2*); Maidenhead Coppice, *E. G. Britton* (*3254 p.p.*); Carmichael, *E. G. Britton* (*443 p.p.*). Crooked Island: Stopper Hill, *Brace* (*4816 p.p.*). Tropical America; South Carolina; Florida.

10. MICROLEJEUNEA LAETEVIRENS (Nees & Mont.) Evans, Bryologist **11**: 68. 1908.

Microlejeunea lucens (Tayl.) Evans, Mem. Torrey Club **8**: 157. *pl. 21. f. 1–10.* 1902.

On bark. Abaco: Great Cistern, *Brace* (*1783*). Berry Islands: Lignum Vitae Cay, *Britton & Millspaugh* (*2325*, *2327*). Andros: near Nicholl's Town, *Small & Carter* (*8966 p.p.*). New Providence, Mt. Vernon, *Coker* (*19*); Waterloo, *E. G. Britton* (*765 p.p.*, *6629 p.p.*); Maidenhead Coppice, *E. G. Britton* (*213 p.p.*, *3216*, *3217 p.p.*, *3218*, *3252 p.p.*, *3253*, *3258*, *3259*, *6559*, *6576 p.p.*); Lake Cunningham, *E. G. Britton* (*610 p.p.*); Carmichael, *E. G. Britton* (*443 p.p.*). Cat Island: Orange Creek and vicinity, *Britton & Millspaugh* (*5711*). Widely distributed in tropical America; Virginia; Florida to Louisiana.

11. RECTOLEJEUNEA BERTEROANA (Gottsche) Evans, Bull. Torrey Club **33**: 12. 1906.

Cheilolejeunea versifolia (Gottsche) Schiffn. Bot. Jahrb. **23**: 597. *pl. 5. f. 1–7.* 1897. Evans, Mem. Torrey Club **8**: 145. 1902.

On bark. New Providence: Soldiers Road, *E. G. Britton* (*824 p.p.*); Grantstown, *E. G. Britton* (*565 p.p.*). Cuba; Porto Rico; Florida.

12. **Rectolejeunea Brittoniae** sp. nov.

Yellowish green, becoming brownish with age, growing in depressed mats: stems about 0.08 mm. in diameter, sparingly and irregularly branched, the branches widely spreading, not microphyllous; rhizoids sparingly produced: leaves imbricated, the lobe plane or slightly convex (when moist), scarcely or not at all falcate, obliquely to widely spreading, broadly ovate to orbicular, averaging about 0.5×0.45 mm., arching partially or wholly across axis, antical margin outwardly curved from the base to the broad and rounded or very obtuse apex, postical margin slightly curved or almost straight, forming an almost continuous line with the keel or with a shallow indentation at the junction, margin slightly and irregularly crenulate from projecting cells, sometimes vaguely sinuate; lobule inflated throughout, triangular-ovate, about 0.1 mm. long and of the same width at the base, keel straight or very slightly arched, free margin curved and involute to or beyond the apex, apical tooth straight and slightly projecting, hyaline papilla in a distinct depression, sinus straight or nearly so, very short (two or three cells long); cells of lobe a little convex, averaging about 17μ at the margin, 25μ in the middle, and 30×25μ at the base, walls with indistinct triangular trigones and rarely with oval intermediate thickenings; ocelli none: underleaves distant to contiguous, orbicular, about 0.35 mm. long, bifid about one half, the divisions mostly acute but sometimes obtuse or even rounded, subcordate or rounded at the base, margin crenulate from projecting cells, sometimes indistinctly unidentate on the sides or vaguely sinuate: inflorescence dioicous: ♀ inflorescence sometimes borne on a short branch but usually on a leading branch, innovating on one side, rarely on both, the innovations often soon floriferous but sometimes sterile; bracts widely spreading, complicate, unequally bifid, keel sharp, sometimes very narrowly winged, lobe ovate to obovate, sometimes slightly falcate, maximum size about 0.6×0.4 mm., apex and margin as in the leaves, lobule narrowly ovate to ligulate, about 0.45×0.15 mm., the apex more or less pointed or bidentate; bracteole oblong, 0.5 mm. long, 0.4 mm. wide, tapering somewhat toward base and apex, bifid about one fourth with acute lobes and sinus, margin as in the underleaves; perianth about one third exserted, oblong to obovate, about 0.65 mm. long and 0.45 mm. wide, rounded to truncate at the apex with a short but distinct beak sometimes borne in a slight depression, slightly compressed in the upper part, antical surface plane or with

a low keel, lateral keels sharp, postical keel two-angled, surface smooth or very slightly roughened from projecting cells: ♂ inflorescence terminal on a leading branch or on a short branch, sometimes occupying the entire length of a short branch, often proliferating; bracts mostly in two to six pairs, imbricated, inflated, subequally bifid with a strongly arched keel and rounded divisions; bracteoles extending the whole length of the inflorescence, similar to the underleaves but smaller and usually with more irregular margins; antheridia in pairs: capsule about 0.3 mm. in diameter; spores minutely verruculose, about 12 μ in short diameter; elaters about 7 μ wide. (PLATE 9, FIGURES 1–12.)

On bark. Great Bahama: edge of mangrove swamp, *Britton & Millspaugh* (*2717*). New Providence: Mt. Vernon, *Coker* (*4*); Soldiers Road, *Coker* (*1 p.p., 15 p.p.*), *E. G. Britton* (*692, 817, 821 p.p., 823 p.p., 3166*); Waterloo, *E. G. Britton* (*6598, 6629 p.p., 6641*); Maidenhead Coppice, *E. G. Britton* (*210, 3215 p.p., 3255 p.p., 3257 p.p., 6563, 6564, 6576 p.p.*); vicinity of Lake Cunningham, *N. L. Britton* (*110*), *E. G. Britton* (*609, 610 p.p.*); near Tea House, *E. G. Britton* (*3193 p.p.*); Cleveland, *Mary Brace* (*4*); Grantstown; *E. G. Britton* (*569*); trail west to Southwest Landing, *E. G. Britton* (*468*); near Clifton, *E. G. Britton* (*739 p.p.*); Fox Hills Path, *Britton & Millspaugh* (*2091*). No. 692 may be designated the type. The species is included under *Cheilolejeunea phyllobola* in Coker's list.

In the various species of *Rectolejeunea* vegetative reproduction is accomplished by means of leaves which break away from the stems and branches and attach themselves to the substratum by scattered rhizoids. The latter grow out directly from marginal leaf cells and sometimes make their appearance before the leaves become separated. The deciduous leaves give rise to new leafy shoots by a process of regeneration. In most cases a leaf will bear but a single leafy shoot, although two or even three are occasionally developed. Apparently a shoot always arises from a marginal leaf cell.

In *R. flagelliformis* Evans,* of Cuba and Porto Rico, and also in *R. Berteroana* the deciduous leaves are strikingly modified and are borne on peculiar flagelliform branches with short internodes and limited growth. These branches spread at

* Bull. Torrey Club **33**: 9. *pl. 1. f. 10–25.* 1906.

right angles to the substratum and give a very strange appearance to tufts where they occur abundantly. In *R. phyllobola* the deciduous leaves are less modified, and the shoots upon which they are borne develop internodes of the usual length and continue their growth for a longer period. Even here, however, the shoots acquire a characteristic appearance when a long series of leaves has fallen away leaving the underleaves behind. In *R. Brittoniae* the conditions are much the same as in *R. phyllobola*, the internodes being so long that the underleaves do not overlap. The modifications shown by the deciduous leaves, although slight, are not without interest. The lobes are smaller than on ordinary leaves, and the lobules are so reduced in size that they consist of only a few cells. The postical margins of the lobes are distinctly rounded at the base and form acute angles with the axis. The marginal crenulations are usually better marked than on normal leaves, but this difference is not always apparent. The separation takes place very close to the line of attachment, the basal cells being usually torn across. In all cases the rudimentary lobules are left behind. The leafy shoots which arise from the deciduous leaves, at first bear small and simple leaves, as in other members of the genus, but these soon increase in size and complexity with the further development of the shoot. The underleaves, as a rule, make their appearance very early. The tendency to develop shoots with deciduous leaves is much less marked in *R. Brittoniae* than in its allies, the majority of the plants forming normal shoots only.

The relationship between *R. Brittoniae* and *R. phyllobola* is very close, the leaves, underleaves, and perianths being much alike in the two species. Even the leaf cells agree closely in structure and are very nearly equal in size. There are, however, two important differences: in *R. phyllobola* the inflorescence is autoicous, and the bracteoles of the antheridial spikes are restricted to the base, except of course when only one or two pairs of bracts are present; in *R. Brittoniae*, on the other hand, the inflorescence is dioicous, and the bracteoles are found along the whole length of the antheridial spikes. The species is also a little more robust than *R. phyllobola*, and the underleaves are larger and have broader and usually blunter divisions; in *R. phyllobola*, for example, the divi-

sions are often tipped with two superimposed cells, a condition which is exceedingly rare in *R. Brittoniae*. Unfortunately, in sterile material, the various parts tend to be poorly or abnormally developed, so that it is sometimes difficult to make a positive determination.

13. RECTOLEJEUNEA PHYLLOBOLA (Nees & Mont.) Evans, Bull. Torrey Club **33**: 15. 1906.

Cheilolejeunea phyllobola Schiffn. Evans, Mem. Torrey Club **8**: 143. *pl. 20. f. 1–13.* 1902.

On bark and rocks. Great Bahama: West End, *Brace* (*3607*). Berry Islands: Lignum Vitae Cay, *Britton & Millspaugh* (*2323*). Andros: road to Morgan's Bluff, *Brace* (*6684*). New Providence: Soldiers Road, *Coker* (*6*); Carmichael, *E. G. Britton* (*442*). Eleuthera: caves near the Bluff, *E. G. Britton* (*6518*). Cat Island: Port Howe and vicinity, *Britton & Millspaugh* (*5972*). Watlings Island: Cockburn Town and vicinity, *Britton & Millspaugh* (*6125, 6134 p.p.*). Tropical North America; Florida; Bermuda.

14. CHEILOLEJEUNEA DECIDUA (Spruce) Evans, Bull. Torrey Club **33**: 6. *pl. 1. f. 1–9.* 1906.

On logs. Andros: near Nicholl's Town, *Small & Carter* (*8925a p.p.*). Florida; Porto Rico; Brazil.

15. EUOSMOLEJEUNEA CLAUSA (Nees & Mont.) Evans, Bryologist **11**: 69. 1908.

Euosmolejeunea opaca (Gottsche) Steph. Evans, Mem. Torrey Club **8**: 139. *pl. 19. f. 1–11.* 1902.

On logs. New Providence: Soldiers Road, *E. G. Britton* (*3170*). Widely distributed in tropical America; Florida and Alabama; Bermuda.

16. EUOSMOLEJEUNEA DURIUSCULA (Nees) Evans, Mem. Torrey Club **8**: 135. *pl. 18. f. 12–23.* 1902.

On bark, rarely on rocks. Abaco: Marsh Harbor, *Brace* (*1816*). Andros: near Nicholl's Town, *Small & Carter* (*8966 p.p.*). New Providence: Soldiers Road, *E. G. Britton* (*823 p.p., 165 p.p., 3171*); Maidenhead Coppice, *E. G. Britton* (*256 p.p., 3251, 3252 p.p., 6555a, 6556*); Grantstown, *E. G. Britton* (*558*); coppice near Race Course, *E. G. Britton* (*3419*); north slope of Blue Hills,

E. G. Britton (*584 p.p.*). Widely distributed in tropical America; Florida to Louisiana.

17. EUOSMOLEJEUNEA TRIFARIA (Nees) Schiffn. Evans, Bull. Torrey Club **30**: 558. *pl. 22. f. 1–10.* 1903.

On logs. New Providence: Soldiers Road, *E. G. Britton* (*825*); Waterloo, *E. G. Britton* (*6631*). Widely distributed in tropical regions throughout the world.

18. CERATOLEJEUNEA CUBENSIS (Mont.) Schiffn.

On logs. Andros: near Nicholl's Town, *Small & Carter* (*8925a p.p.*). Widely distributed in tropical America; Florida.

19. **Ceratolejeunea integrifolia** sp. nov.

Olive green to olive brown, growing in depressed mats: stems 0.06 mm. in diameter, not closely appressed to the substratum, loosely and irregularly pinnate, the branches widely to obliquely spreading, tending to become parallel in old mats, similar to the stem: leaves imbricated, the lobe widely spreading, slightly convex, somewhat falcate, ovate, 0.35 mm. long, 0.3 mm. wide, arching partially or wholly across axis, antical margin strongly outwardly curved to the apex, postical margin straight or slightly curved, forming an obtuse angle with the keel, apex broad, rounded to very obtuse, margin entire or vaguely and irregularly sinuate; lobule conforming to the type normal for the genus,* though sometimes poorly developed, inflated throughout, ovate, 0.1 mm. long, 0.08 mm. wide, keel arched, very slightly roughened from projecting cells, free margin straight or slightly curved when explanate, involute to apex and arched in natural position, apical tooth short and curved, tapering to a blunt point, hyaline papilla in a slight depression, sinus lunulate; cells of lobe plane or a little convex, averaging about 9μ at the margin, 15μ in the middle, and 18 × 15μ at the base, walls apparently uniformly thickened, the pits very indistinct; ocelli mostly two (rarely three to five), situated side by side near base of lobe, measuring about 35 × 16μ: underleaves distant, orbicular, mostly from 0.18 to 0.25 mm. long, broadly cuneate to rounded at the base, bifid about one half with suberect triangular divisions, acute (rarely obtuse) at the apex, and an acute sinus, margin entire or nearly so, rarely with vague indications of rounded lateral teeth: inflorescence dioicous: ♀ inflorescence sometimes borne on a leading branch, sometimes on a more or less abbreviated branch (the latter in extreme cases bearing only one leaf in addition to the bracts), innovating on one

*See Evans, Bull. Torrey Club **32**: 275. 1905.

side, the innovation usually simple and sterile; bracts obliquely spreading, complicate with a sharp keel, deeply and unequally bifid, the lobe ovate, mostly 0.45 − 0.6 mm. long and 0.3−0.35 mm. wide but sometimes considerably smaller, rounded to acute at the apex, entire or with an occasional tooth, lobule ovate, mostly 0.35−0.45 mm. long and 0.18−0.2 mm. wide, usually coarsely and irregularly one- to three-cleft in the apical region; bracteole slightly connate on one side, ovate, reaching a maximum size of about 0.5 × 0.25 mm., bifid about one half with suberect acute divisions often reflexed at the apex and a narrow sinus, margin entire or very sparingly and irregularly dentate (rarely with more than one tooth on a side): ♂ inflorescence occupying a short branch or terminal on a more or less elongated branch, often proliferating at the apex; bracts mostly in two or three pairs, rarely in four or five, loosely imbricated, strongly inflated with an arched keel roughened from convex cells, unequally to subequally bifid with blunt divisions; bracteole usually single, at base of inflorescence, similar to the underleaves but smaller: perianth and sporophyte not seen. (PLATE 9, FIGURES 13–19.)

On bark. New Providence: Soldiers Road, *E. G. Britton* (*819 p.p., 822*); Waterloo, *E. G. Britton* (*721*); Maidenhead Coppice, *E. G. Britton* (*3220*). Specimens from Florida, collected by Rapp near Sanford, on April 12, 1903, and later, should be referred to this same species. No. 721 may be designated the type.

The specimens above described, although destitute of perianths, are so abundant that they give a fairly good idea of the extent to which the species varies. The characters to be emphasized are the following: the dioicous inflorescence, the basal ocelli, the absence of teeth on the leaves, the usually rounded lobes, the small leaf cells with their walls apparently uniformly thickened, the lack of modified lobules (utriculi, etc.), the small underleaves not cordate at the base, the rarity of teeth on the lobes of the perichaetial bracts and on the bracteoles. The leaf cells bear some resemblance to those of the peculiar West Indian *C. patentissima* (Hampe & Gottsche) Evans,* the pits being equally minute and difficult to demonstrate; the cell cavities, however, are sometimes a little more wavy. The variability in the perichaetial bracts deserves a few words of comment. As the figures show, the bract subtended by the innovation is usually distinctly smaller than the

* Bull. Torrey Club **32**: 287. *pl. 20. f. 19–26.* 1905.

other and the lobe is more sharply pointed. In most cases the lobe shows no teeth whatever, but occasionally one or more angular teeth can be distinguished. The condition described for the lobule may be considered typical, but the number of teeth present in the apical region varies considerably and they are not always sharp. In rare cases the apex of the lobule is merely truncate or retuse with blunt angles. When several teeth are present the apical tooth usually projects beyond the others, and the hyaline papilla may be discerned at the bottom of the sinus on its proximal side. The bracteoles vary in much the same way as the lobes, the divisions being usually entire but sometimes variously dentate. On account of the frequency with which the apices of the divisions are inflexed, it is often difficult to observe the peculiarities of the bracteole clearly without dissection.

Among the species allied to *C. integrifolia* it will be sufficient to mention *C. cubensis*. In this plant the lobules, underleaves, bracts, and bracteoles are much the same as in the new species except that the lobes of the bracts and the divisions of the bracteoles tend to be more regularly toothed. The leaf cells, also, are very similar and there are no differences in the ocelli; the cells, however, sometimes show distinct trigones and intermediate thickenings. The autoicous inflorescence of *C. cubensis* and the dentate leaf lobes will at once serve to distinguish it. The teeth are situated in the apical region of the lobes and usually vary from two to five; they tend to be more conspicuous on branch leaves and are occasionally indistinct on robust stem leaves.

20. **Taxilejeunea obtusangula** (Spruce) comb. nov.

Lejeunea (*Taxi-Lejeunea*) *obtusangula* Spruce, Hep. Amaz. et And. 221. 1884.

Pale green, growing among other hepatics or forming loose depressed mats: stems 0.12 mm. in diameter, loosely and irregularly pinnate, the branches widely spreading, usually with smaller leaves than the stem, at least in basal portions: leaves loosely to closely imbricated, the lobe obliquely spreading, more or less convex, not falcate, orbicular-ovate to ovate, 0.6 mm. long and 0.5 mm. wide on robust sterile axes, arching partially across to considerably beyond the axis, antical margin more or less strongly curved from base to apex, postical margin slightly curved, forming a continuous line or a very obtuse angle with the keel, apex broad

and very obtuse or, more commonly, abruptly apiculate, margin minutely crenulate from projecting cells and sometimes vaguely angular-sinuate or angular-dentate in outer part; lobule inflated throughout, ovate, 0.12 mm. long, 0.08 mm. wide, keel more or less arched, slightly roughened from convex cells, free margin straight or a little curved, involute to or beyond the apex, the latter (not clearly seen without dissection) consisting of a single straight and slightly projecting cell bearing a hyaline papilla at its proximal base, sinus shallow, two or three cells long; cells of lobe slightly convex on both free surfaces, averaging 16 μ at the margin and 32 $\times$ 18 μ in median and basal regions, thin-walled but with distinct triangular trigones and occasional elliptical intermediate thickenings: underleaves distant to contiguous, plane, orbicular to broadly orbicular, measuring 0.3$\times$0.35 mm. on robust axes but often much smaller, cuneate at the base on slender branches but typically rounded to cordate, bifid one third to one half with erect triangular divisions, mostly acute at the apex and tipped with a single cell, rarely rounded, obtuse or apiculate, sinus acute, margin entire or slightly crenulate, rarely vaguely sinuate; inflorescence autoicous: ♀ inflorescence sometimes borne on a leading branch, sometimes on a more or less abbreviated branch (the latter in extreme cases bearing only one leaf in addition to the bracts), innovating on one side, rarely on both, the innovation sometimes simple but usually branched and often again florif-erous; bracts obliquely spreading, more or less complicate with a blunt keel, lobe narrower than in the leaves, oblong to oblong-lanceolate, 0.6 mm. long, 0.25 mm. wide, narrowed to the acute or obtuse apex, margin slightly crenulate and irregularly sinuate or sinuate-dentate, lobule very variable, averaging about 0.15$\times$ 0.08 mm., usually ligulate in outline, the apex blunt or sharp and the margin entire or nearly so; bracteole broadly oblong to oblong-quadrate, averaging about 0.5$\times$0.35 mm., bifid about one third with erect or connivent acute divisions and a very narrow sinus, margin minutely crenulate and often irregularly sinuate-dentate, occasionally with one or two sharp lateral teeth; perianth obovoid from a narrow base, 0.65 mm. long, 0.4 mm. wide, often developing a long cylindrical stipe after fertilization, truncate at the apex with rounded angles, terete below, bluntly five-keeled in apical region, beak none, surface more or less roughened from convex cells especially along the keels: ♂ inflorescence occupying a short branch, not proliferating; bracts in two to six pairs, im-bricated, delicate in texture (the cells without local thickenings), shortly and subequally bifid with a strongly arched keel and obtuse to subacute divisions; bracteoles restricted to base of inflorescence, minute, orbicular, similar to the underleaves; antheridia borne

singly: capsule about 0.2 mm. in diameter; spores greenish, minutely verruculose, about 16μ in short diameter; elaters about 9μ wide. (PLATE 10.)

On rocks. New Providence: Maidenhead Coppice, *E. G. Britton* (*256 p.p., 3248, 3249*); without definite locality, *A. E. Wright* (communicated by W. G. Farlow). The species was described by Spruce from specimens which he collected on the trunks of palm trees in the vicinity of Para, Brazil. These specimens were afterwards distributed in Hepaticae Spruceanae. They tend to be a little more robust than the Bahamian plants but agree with them in all essential respects. No other stations for the species are at present known, although its occurrence is surely to be expected in the Antilles and in other intermediate regions.

The great variability of *Taxilejeunea obtusangula* is one of its striking characteristics, and the fact should be emphasized that the perianths are often borne on slender branches which show the typical vegetative peculiarities of the species much less clearly than robust and sterile shoots. The underleaves and the perichaetial bracts are perhaps the most variable organs. Spruce describes the underleaves as imbricated and cordate. The imbrication, however, seems to be exceedingly rare except near the tips of vigorous branches, and although the cordate condition may be considered typical, the majority of the underleaves are rounded or even cuneate at the base. The bracts are especially variable in their lobules, and there is sometimes a marked difference between the outer bract of an inflorescence and the inner bract, especially when the latter is the only one subtended by an innovation. Under these circumstances the lobule of the outer bract is sometimes very slightly modified and may be inflated in much the same way as on ordinary leaves; the lobule of the inner bract, however, is invariably narrow and plane. In other cases the outer bract, even when no innovation subtends it, shows the same modification as the inner bract. Very frequently the lobule is nothing more than a fold at the base of the lobe and can scarcely be distinguished when the bract is spread out flat. The perianth is remarkable because it develops no beak; it simply contracts at the apex to a small circular opening.

The position of *T. obtusangula* in the genus *Taxilejeunea* is

somewhat aberrant, as Spruce has already pointed out. In most of the species which have been referred to this genus the female branch is repeatedly floriferous by innovations and thus gives rise to a sympodial cluster, which bears a series of flowers or perianths along its upper side. In *T. obtusangula* there is no approach to such a condition. The innovation is frequently completely sterile, and even when it is floriferous there is so much space between the two flowers that there is no question of a cluster. The absence of this particular character indicates an approach to the genus *Lejeunea*, but the other characters of the species seem to warrant its retention in *Taxilejeunea*, especially since other species of this genus have been described in which there are no distinct clusters or in which such clusters are only occasionally developed.

21. LEPTOLEJEUNEA ELLIPTICA (Lehm. & Lindenb.) Schiffn. Evans, Bull. Torrey Club **29**: 499. *pl. 23. f. 1–7.* 1902.

On bark. New Providence: Soldiers Road, *E. G. Britton* (*824 p.p.*). Widely distributed in the tropical regions of America, Asia, and the Pacific Islands. Usually growing on living leaves.

22. BRACHIOLEJEUNA BAHAMENSIS Evans, Bull. Torrey Club **35**: 383. *pl. 28. f. 1–14.* 1908.

On bark. Abaco: Old Kerr's Point, *Brace* (*2027 p.p.*). New Providence: Soldiers Road, *Coker* (*1 p.p.*); ten miles west of Nassau, *Coker* (*2*); near Tea House, *E. G. Britton* (*3191*); Grantstown, *E. G. Britton* (*562*); Fox Hills Path, *Britton & Millspaugh* (*2090*); north slope of Blue Hills, *E. G. Britton* (*584 p.p.*). Watlings Island: Cockburn Town and vicinity, *Britton & Millspaugh* (*6120, 6134 p.p.*). Crooked Island: Stopper Hill, *Brace* (*4816*), the type; road to Vauxhall, *Brace* (*4746*). In Coker's list the species appears as *B. corticalis*. Cuba; Florida. The Florida specimens, which have not before been reported, were detected by Miss C. C. Haynes; they were collected by Small and Nash on Old Rhodes Key, south of Miami (*464 p.p.*).

23. BRACHIOLEJEUNEA CORTICALIS (Lehm. & Lindenb.) Schiffn. Evans, Mem. Torrey Club **8**: 131. *pl. 18. f. 1–11.* 1902.

On bark. Great Bahama: Pinder's Point, *Britton & Millspaugh* (*2533*); Barnett's Point, *Britton & Millspaugh* (*2646*);

Golden Grove, *Britton & Millspaugh* (*2719, 2723*). Cat Island: the Bight and vicinity, *Britton & Millspaugh* (*5899*). Tropical America; Florida.

24. LOPHOLEJEUNEA SAGRAEANA (Mont.) Schiffn. Evans, Bull. Torrey Club **34**: 24. *pl. 3. f. 10–20.* 1907.

On bark. Andros: near Nicholl's Town, *Small & Carter* (*8966 p.p.*). New Providence: Soldiers Road, *E. G. Britton* (*818, 824 p.p.*); Waterloo, near old fort, *E. G. Britton* (*2*); Maidenhead Coppice, *E. G. Britton* (*3215 p.p., 3217 p.p., 3250 p.p., 3254 p.p., 3257 p.p., 6554, 6577, 6578*). Widely distributed in tropical America; Florida; also reported from Africa and the East Indies.

25. CAUDALEJEUNEA LEHMANNIANA (Gottsche) Evans, Bull. Torrey Club **34**: 554. *pl. 33. f. 1–12.* 1907.

On twigs. New Providence: Maidenhead Coppice, *E. G. Britton* (*257*). Widely distributed in tropical America; Florida. The Florida specimens have not before been reported; they were collected by Small and Carter near Long Prairie (*2812 p.p.*) and determined by Miss Haynes, who has kindly communicated a portion of the material.

26. MASTIGOLEJEUNEA AURICULATA (Wils. & Hook.) Schiffn. Evans, Mem. Torrey Club **8**: 129. *pl. 17. f. 10–19.* 1902.

On bark and rocks. Andros: near Nicholl's Town, *Small & Carter* (*8967*). New Providence: Mt. Vernon, *Coker* (*7*); Soldiers Road, *E. G. Britton* (*687, 688, 3165, 3169*); Southeast Road, *Coker* (*3*); Waterloo, *E. G. Britton* (*1*); Farringdon Road, *E. G. Britton* (*219, 3260*); Maidenhead Coppice, *E. G. Britton* (*251, 3214, 3250 p.p., 6574*). Widely distributed in tropical America; Florida to Louisiana.

27. ARCHILEJEUNEA VIRIDISSIMA (Lindenb.) Evans, Bull. Torrey Club **35**: 169. *pl. 8. f. 1–8.* 1908.

On bark. Great Bahama: Eight Mile Rocks, *Britton & Millspaugh* (*2605*). Venezuela; Porto Rico; Jamaica.

28. LEUCOLEJEUNEA UNCILOBA (Lindenb.) Evans, Torreya **7**: 228. 1908.

Archilejeunea Sellowiana Steph. Evans, Mem. Torrey Club **8**: 125. *pl. 16. f. 12–20.* 1902.

On bark. New Providence: Soldiers Road, *E. G. Britton* (*666, 3172 p.p.*). Widely distributed in tropical America; Rhode Island south to Florida and west to Texas.

29. LEUCOLEJEUNEA XANTHOCARPA (Lehm. & Lindenb.) Evans, Torreya **7**: 229. 1908. Bull. Torrey Club **35**: 172. *pl. 7. f. 12–23.* 1908.

On bark. New Providence: Nassau, *A. E. Wight* (communicated by W. G. Farlow); Soldiers Road, *E. G. Britton* (*3168*); Maidenhead Coppice, *E. G. Britton, 3247 p.p.*). Widely distributed in tropical America; Africa; Java.

30. FRULLANIA ARIETINA Tayl.

On twigs. New Providence: Grantstown, *E. G. Britton* (*557*). Widely distributed in tropical America; Florida.

31. FRULLANIA GIBBOSA Nees.

On bark. Abaco: Old Kerr's Point, *Brace* (*2022*). New Providence; Soldiers Road, *Coker* (*18 p.p.*); Waterloo, *E. G. Britton* (*3 p.p.*); Maidenhead Coppice, *E. G. Britton* (*3247 p.p.*); Lake Cunningham, *E. G. Britton* (*645 p.p.*); near Tea House, *E. G. Britton* (*3194*); near Clifton, *E. G. Britton* (*739 p.p.*). Widely distributed in tropical America: Alabama.*

32. FRULLANIA OBCORDATA Lehm. & Lindenb.

Frullania caroliniana Sulliv.

On bark. New Providence: Soldiers Road, *E. G. Britton* (*820 p.p., 3164 p.p.*); Maidenhead Coppice, *E. G. Britton* (*3247 p.p.*); Lake Cunningham, *E. G. Britton* (*645 p.p.*); Grantstown, *E. G. Britton* (*565 p.p.*); Rifle Range Coppice, *E. G. Britton* (*561 p.p.*). Tropical America; Florida to Louisiana.

33. FRULLANIA RIOJANEIRENSIS (Raddi) Spruce.

On twigs. New Providence, *E. G. Britton* (*557*). Widely distributed in tropical America.

34. FRULLANIA SQUARROSA (R. Bl. & N.) Dumort.

On bark. Great Bahama: near Eight Mile Rocks, *Brace* (*3718*). Berry Islands: Lignum Vitae Cay, *Britton & Millspaugh* (*2330*). New Providence: Mt. Vernon, *Coker* (*9*); Soldiers Road, *Coker* (*11*),

*According to Stephani, Species Hepat. **4**: 344. 1910. This is the first record for the United States.

E. G. Britton (*823 p.p., 3164 p.p., 3167, 3172 p.p., 3173*); Waterloo, *E. G. Britton* (*6632, 6639*); Maidenhead Coppice, *E. G. Britton* (*3217 p.p., 6553, 6575*); Lake Cunningham, *E. G. Britton* (*641*); near Clifton, *E. G. Britton* (*739 p.p.*); Carmichael, *E. G. Britton* (*440, 443 p.p.*); Seven Hills, *E. G. Britton* (*3361*). Eleuthera: near the Bluff, *E. G. Britton* (*6523*). Anguilla Isles: South End, Salt Key Bank, *Wilson* (*8054*). Widely distributed in tropical regions throughout the world; Connecticut to Ohio and south to Florida and Louisiana; Bermuda.

It will be seen from the species listed that the Jubuleae comprise seven eighths of the entire number and that the Metzgeriaceae are as yet unrepresented in the collections made on the Islands. The Anthocerotaceae are not wholly absent. Sterile specimens of an *Anthoceros* allied to *A. levis* L. were collected by Brace along the Adelaide Road, New Providence (*3917*), but it is impossible to identify them without sporophytes. The preponderance of the Jubuleae indicates the tropical character of the hepatic flora. All but five of the species, in fact, are definitely known from the Antilles and all but ten from Florida, numbers that will doubltess be reduced upon further exploration. Most of the species which occur in the Antilles are confined to the lowlands, even on mountainous islands, although a few of them follow the path of civilization into higher altitudes and make their appearance along roadsides and in plantations. It seems rather surprising at first that only five of the Bahamian species are known from Bermuda.* The flora of the more northern island, however, is much more closely related to that of the northeastern United States, even though it does contain certain subtropical elements.

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*See Evans: The Hepaticae of Bermuda. Bull. Torrey Club **33**: 129–135. *pl. 6.* 1906.

Explanation of plates 9 and 10

The figures were drawn by the writer and prepared for publication by Mr. Stanley C. Ball.

PLATE 9

Rectolejeunea Brittoniae Evans. 1. Part of a branch bearing a perianth with a second female inflorescence on the innovation, postical view, ×35. 2. Part of a leading branch with a male inflorescence, proliferating at the apex, postical view, ×35. 3. Part of a robust sterile branch, postical view, ×35. 4. Leaf, antical view, × 35. 5. Cells from middle of lobe, ×265. 6. Apex of lobe, ×200. 7. Apex of lobule, ×200. 8. Apex of an underleaf division, ×200. 9–11. Bracts and bracteole from a single involucre, ×35. 12. Transverse section of perianth in apical region, ×35. The figures were all drawn from specimens collected by E. G. Britton; FIG. 2, 5, 6, and 7 from *6598*, the others from the type specimen (*692*).

Ceratolejeunea integrifolia Evans. 13. Part of a leading branch with a female inflorescence, postical view, ×35. 14. Part of a leading branch bearing two short branches with female inflorescences, postical view, ×35. 15. Two leaves, antical view, ×35. 16. Cells from middle of lobe, ×265. 17. Apex of lobule, ×200. 18. Apex of an underleaf division, ×200. 19. Bract and bracteole, ×35. The figures were all drawn from the type specimen (*721*).

PLATE 10

Taxilejeunea obtusangula (Spruce) Evans. 1. Part of a leading branch with a perianth and a male inflorescence, postical view, ×35. 2. Short branch with a perianth, postical view, ×35. 3. Part of a robust sterile branch, postical view, ×35. 4. Two leaves, antical view, ×35. 5. Cells from middle of lobe, ×265. 6, 7. Apices of lobes, ×200. 8. Apex of lobule, ×200. 9. Cells from base of underleaf, ×200. 10. Apex of an underleaf division, ×200. 11–13. Bracts and bracteole from a single involucre, ×45. 14–16. Bracts and bracteole from another involucre, × 45. 17. Transverse section of perianth above middle, ×35. The figures were all drawn from specimens collected by E. G. Britton; FIG. 3–10 from *2340*, the others from *256*.

Early spring aspects of the coastal plain vegetation of South Carolina, Georgia, and northeastern Florida

ROLAND M. HARPER

The first week in March, 1910, I journeyed from Washington, D. C., to Jacksonville, Fla., on a through train of the Southern Railway, traversing the Piedmont region from Washington to a few miles north of Columbia, S. C., and the coastal plain the rest of the way. That part of the route lying in the Piedmont region has been in operation, and the region as a whole has been fairly thickly settled, so long that the opportunities for studying natural vegetation from the train along there are now rather limited. But in the coastal plain portion civilization has not yet made such serious inroads. That part of the railroad in South Carolina between Columbia and Perry, 32 miles, and Allendale and Hardeeville, 51 miles, is only about a dozen years old, having been built by the Southern Railway in the last few years of the nineteenth century in order to gain an entrance into Savannah. From Hardeeville to Jacksonville the tracks of the Atlantic Coast Line are used, and of this the part between Jesup and Folkston, Georgia, 54 miles, was built by the Plant System, shortly before its absorption by the Atlantic Coast Line in 1902, to shorten its mileage between Savannah and Jacksonville by about 20 miles. Even along the older parts of the railroads in the coastal plain, such as that between Savannah and Jesup, which has been in operation for half a century, there is still a much larger proportion of the original forest to be seen than in the Piedmont region.

The schedules of the only through train on that route at the time indicated were most convenient for my purposes. Most of the Piedmont region, where what little remains of the vegetation had hardly awakened from its winter sleep (spring having been a little late in the South in 1910), was traversed at night, while in the coastal plain portion of the route, where the vegetation was more advanced, phenologically speaking—mainly on account of the lower latitude and altitude—and there is more for a botanist

to see even in winter, I had daylight all the way. It happens also that I had been over all the Piedmont portion of this route, between Washington and Columbia, by daylight in former years; while south of Columbia it was all new to me except three sections in Georgia, namely, from the Savannah River to Jesup, 74 miles, Hortense to Nahunta, 9 miles, and Folkston to the St. Mary's River, 3 miles. From Columbia to Savannah, however, I was nowhere more than 12 miles from the Seaboard Air Line, on which I had traveled northward a little more than seven months previously.*

The train I was on made about 45 miles an hour, including regular stops (which were few); and at that speed I could not identify many herbs, especially so early in the season. However, some observations of more than passing interest were made on the woody plants, some of which are rapidly becoming scarcer along the route to be described, owing to the "pernicious activity" of lumbermen and farmers.

At daybreak on the fourth of March I was just passing Blythewood, S. C., which is about 20 miles north of Columbia and at the inland edge of the fall-line sandhills, whose summer vegetation I described superficially last year.† These sandhills continued all the way across Richland and Lexington counties, and to the vicinity of Perry in Aiken County, 32 miles south of Columbia. In this region the lumbering of long-leaf pine seems to have practically ceased, and the turpentine industry (which is based on the same tree) nearly so. Agriculture has not quite kept pace with the destruction of the pines, and the region is still very sparsely settled, except in the immediate vicinity of Columbia and other fall-line cities. The highest and barrenest portions of the sandhills, on this route at least, seemed to be about 15 miles south of the Saluda River, or approximately halfway between Columbia and Perry.

The following plants were observed more than once in passing through the sandhill country.‡

*See Bull. Torrey Club **37**: 407, 592. 1910–11. My 1910 route crossed that of 1909 at an unnamed point about two-thirds of the way from Columbia to Savannah.

†Bull. Torrey Club **37**: 412, 413. 1910.

‡In this and the subsequent lists evergreens are indicated by bold-faced type, which will aid the reader in picturing to himself how they stand out conspicuously

TREES		SHRUBS	
20	**Pinus palustris**	6	**Phoradendron flavescens**
16	Quercus Catesbaei	4	**Smilax laurifolia**
7	Nyssa biflora	3	**Arundinaria tecta**
6	**Pinus Taeda**	3	**Ceratiola ericoides**
5	**Pinus serotina**		
4	**Pinus echinata**		HERBS
2	Liriodendron Tulipifera	4	Kuhnistera pinnata
2	**Magnolia glauca**	3	Andropogon virginicus
2	Acer rubrum	3	**Lupinus diffusus**
2	**Chamaecyparis thyoides**		

The relatively higher rank of most of the evergreens in this list, as compared with the same species in the corresponding list in my previous paper, is of course due mostly to the pre-vernal leaflessness of the deciduous trees. The two non-evergreen herbs mentioned have stiff erect stems which are just about as conspicuous in winter as in summer.

From about Perry to Allendale, 46 miles, I was in the "middle country" or "upper pine belt" (previously described*), which is somewhat less hilly and less sandy than the sandhills, and mostly under cultivation, as I have stated elsewhere. The following plants were noted as characteristic. (The names of introduced species are in parentheses.)

TREES		SHRUBS	
18	**Pinus Taeda**	5	**Phoradendron flavescens**
17	**Pinus palustris**	5	**Smilax laurifolia**
10	Taxodium imbricarium	5	**Arundinaria tecta**
7	Acer rubrum	5	(Prunus angustifolia) †
6	Quercus Catesbaei		
6	Nyssa biflora		HERBS
4	**Magnolia glauca**	4	**Tillandsia usneoides**
3	Quercus marylandica	2	(Isopappus divaricatus)
2	Liquidambar Styraciflua	2	Erianthus sp. (in shallow ponds)
2	(Melia Azederach)		
2	**Quercus nigra**		

The pine barrens may be said to begin with the appearance of

in the winter landscape. The figures here have the same significance as in my 1910 paper above referred to.

*L. c. 411–412.

†This was the only deciduous shrub identified from the train that day. It happened to be in bloom at the time; otherwise I might have not noticed it quite so often.

Pinus Elliottii, near Allendale. The transition from the undulating farming region, just described, to the more typical flat damp pine barrens dotted with shallow ponds is very gradual, however, and the exact boundary cannot be located at present within several miles. A brief description of this kind of country, based on observations made mostly in the same county (Hampton) in 1906 and 1909, has already been published.* Although the railroad between Allendale and Hardeeville is only about a dozen years old, as stated above, the lumbermen have already cut nearly every pine tree within sight of it, that was worth taking. Many of the logs however were doubtless hauled to other railroads near by, or to the Savannah River, before this railroad was built. A pretty good description of the southern part of the region now under consideration can be found in Bulletin 43 of the U. S. Bureau of Forestry, entitled "A working plan for forest lands in Hampton and Beaufort counties, South Carolina," by Thomas H. Sherrard, published in 1903.

The following plants were noted in the 51 miles of pine barrens traversed in South Carolina.

TREES		SHRUBS	
24	**Pinus Taeda**	9	**Smilax laurifolia**
22	**Pinus Elliottii**	9	**Ilex glabra**
18	**Pinus palustris**	7	**Myrica cerifera**
14	Taxodium imbricarium	6	**Phoradendron flavescens**
10	Nyssa biflora †	5	**Ilex myrtifolia**
10	Acer rubrum	2	**Arundinaria tecta**
7	**Pinus serotina**		
7	**Pinus echinata**	HERBS	
6	**Quercus nigra**	16	**Tillandsia usneoides**
3	**Magnolia glauca**	3	Trilisa odoratissima?
2	**Magnolia grandiflora**	3	Carex Walteriana?
		2	Erianthus sp. (in ponds)

The occurrence in this list of several woody plants of climax tendencies, such as *Pinus Taeda*, *P. echinata*, *Quercus nigra*, *Magnolia grandiflora*, and *Myrica cerifera*, is probably to be explained by the proximity of the Savannah River bottoms in the

*L. c. 409, 410.

† In Mr. Sherrard's report on this region the black gum is referred, probably erroneously, to *Nyssa sylvatica*. See in this connection Bull. Torrey Club **34**: 352. 1907 (fifth footnote).

last few miles. *Quercus Catesbaei* was not seen at all between Allendale and Savannah, probably because the country is not quite high and dry enough for it. It is interesting to note that this list contains five of the six pines which are indigenous to the coastal plain of the Carolinas and Georgia; and the other one, *P. glabra*, was seen in the same region too, but only once. *Pinus palustris* was doubtless originally far more abundant than any other tree in this region.

A mile or so southwest of Hardeeville the railroad enters the bottoms and swamps of the Savannah River, which are here about three miles wide on the South Carolina side and perhaps a little narrower on the Georgia side. Some notes on the swamp timber northwest of Hardeeville (nearer to Purysburg, a place mentioned a few times in Elliott's Botany of South Carolina and Georgia) can be found in the paper by Sherrard, above mentioned.

The following plants were noted more than once in the first seven or eight miles after leaving Hardeeville.

TREES	SHRUBS
6 Acer rubrum	4 **Sabal glabra**
5 **Pinus Taeda**	3 **Phoradendron flavescens**
4 Taxodium distichum	3 **Arundinaria macrosperma**
4 Nyssa uniflora	2 **Myrica cerifera**
4 Liquidambar Styraciflua	
4 **Quercus nigra**	HERBS
3 **Pinus echinata**	8 **Tillandsia usneoides**
2 Ulmus sp.	7 Zizania aquatica
2 **Magnolia grandiflora**	
2 Salix nigra?	

From the river to Savannah and thence southwestward to within a mile and a half of Walthourville, a total distance of about 53 miles, the railroad is mostly in what might be called the coast region of Georgia, though farther inland than the salt marshes and live oak hammocks, which are characteristic of the region. Along the railroad the country is very level, the soil is rather silty, or perhaps marly in a few places, and the vegetation is much nearer the climax condition than it is in the pine barrens a little farther inland. A few estuaries which were crossed bring to view a number of marsh plants, only a few of which were seen more than once, however.

A large part of the coast region has been under cultivation ever since the colony of Georgia was founded, about 175 years ago, and most of the inhabitants are negroes, as is the case in many other parts of the South where agriculture has long been the leading industry. This region corresponds in part to the "savannas" and "live oak bottoms" described by Dr. R. H. Loughridge in his report on the cotton production of Georgia.*

The coastward edge of the pine barrens is rather vaguely defined, and probably irregular as well, and in these 53 miles quite a number of pine-barren plants were seen, which probably indicate tongues or projections of the pine-barren region extending a short distance across the railroad.

It happens that on July 17, 1909, I came into Savannah from the southwest, the last 57 miles being on the same route here described, and then turned westward, passing out of the coast region near Meldrim, about 18 miles from Savannah. In order to compare the summer and winter aspects of the vegetation along what is for the most part the same route, I will here place in parallel columns the results of the two trips, the first from Walthourville to Savannah and Meldrim, 56 miles, and the second from the Savannah River to Savannah and near Walthourville, 53 miles.

July	*March*
TREES	TREES
33 **Pinus Taeda**	29 **Pinus Taeda**
24 Liquidambar Styraciflua	20 Acer rubrum
23 Nyssa biflora	15 Nyssa biflora
20 **Pinus serotina**	15 **Pinus serotina**
12 Taxodium imbricarium	12 **Pinus palustris**
11 **Pinus Elliottii**	8 **Pinus Elliottii**
6 **Pinus palustris**	8 **Magnolia glauca**
6 Acer rubrum	7 **Quercus nigra**
4 Taxodium distichum	6 **Magnolia grandiflora**
3 Nyssa uniflora	5 Liquidambar Styraciflua
2 Nyssa Ogeche	4 Taxodium imbricarium

*Tenth Census U. S. **6**: 317, 318, 423, 424. 1884. Also in Henderson's Commonwealth of Georgia, 114–116. 1885. Later descriptions of the same region can be found in Ann. N. Y. Acad. Sci. **17**: 20. 1906; and in the preliminary reports on the soils in the vicinity of Savannah and Brunswick by J. A. Bonsteel and H. H. Bennett, respectively (circulars 19 and 21 of the U. S. Bureau of Soils, July, 1909, and February, 1910).

2 **Pinus echinata**
2 Quercus Phellos

SHRUBS

5 **Serenoa serrulata**
4 **Phoradendron flavescens**
3 **(Baccharis halimifolia)**
3 **Myrica cerifera**
2 Clethra alnifolia

HERBS

23 **Tillandsia usneoides**
8 Eupatorium rotundifolium
6 Eriocaulon decangulare
5 Pluchea bifrons
4 Pontederia cordata
3 Osmunda cinnamomea
3 Scirpus Eriophorum
3 Jussiaea grandiflora
2 Zizania aquatica
2 **Juncus Roemerianus**
etc.

4 Quercus falcata
4 Taxodium distichum
3 Nyssa uniflora
3 **Pinus echinata**
2 **Quercus virginiana**
2 **Juniperus barbadensis?**
(on borders of marshes)

SHRUBS

20 **Myrica cerifera**
12 **Phoradendron flavescens**
8 **Sabal glabra**
6 **Serenoa serrulata**
5 **(Baccharis halimifolia)**
4 **Ilex glabra**
2 **Smilax lanceolata**

HERBS

28 **Tillandsia usneoides**
5 **Juncus Roemerianus**
4 Zizania aquatica
3 **Orontium aquaticum**

It will be noticed that the five pines, also *Taxodium distichum*, *Nyssa uniflora*, *Phoradendron*, *Baccharis*, and *Tillandsia*, occupy the same relative rank, or nearly so, in both lists. *Acer rubrum* and *Liquidambar* just about interchange places, doubtless because in March the former was in fruit, and therefore conspicuous and unmistakable, while the latter is not so readily identified when its characteristic leaves are off, especially in young trees which bear no fruit. *Magnolia glauca*, *M. grandiflora*, and *Myrica cerifera*, which stand higher in the March list, are evergreen, and *Quercus nigra* nearly so in that latitude.

From Walthourville to Jesup, Folkston, and Jacksonville, a distance of about 118 miles, my route was through flat pine barrens, averaging perhaps 50 feet above sea level, dotted with numerous very shallow depressions with no outlets, and traversed by sluggish streams, most of them mere branches, with their channels only a few inches or feet below the general level, and bordered by comparatively wide swamps. This region corresponds approximately with Loughridge's "pine and palmetto flats"* in Georgia, and

* Tenth Census U. S. **6**: 316, 317, 415, 421. 1884. See also Ann. N. Y. Acad. Sci. **17**: 19, 20. 1906; Southern Woodlands 1^3: 20–23. 1907 (where I treated it as a subdivision of the Altamaha Grit region); and Pop. Sci. Monthly **74**: 601, 602. 1909.

with the flatwoods of northeastern Florida, described at the same time by Dr. E. A. Smith.*

In Nassau County, Florida, about 30 miles out from Jacksonville, the railroad crosses obliquely a low sandy ridge which seems to extend parallel to the coast for over 100 miles in Georgia and Florida.† About the only noticeable difference in the country east and west of this ridge is that east of it many of the creeks seem to have cut down through the sand and clay of the pine barrens into marl beds, as indicated by the presence of supposedly calciphile plants like *Taxodium distichum*, *Juniperus*, *Sabal*, *Cladium*, etc., in their swamps.‡

In these flat pine barrens lumbering is a very simple operation, and the lumbermen have already done their worst. Along the route here described the day of the big sawmill§ is past, and small ones and turpentine stills are becoming scarce. The greater part of this destruction of forests was probably accomplished in the decade immediately preceding the building of the short line from Jesup to Folkston. Long-leaf pines are still everywhere in sight, but only small or defective specimens. The farmer is following slowly after the lumberman, and will probably in time obliterate nearly all distinctions between this region and the adjoining ones, except the topography.

Although many plants have been collected in the neighborhood

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*Tenth Census U. S. **6**: 202, 203, 231, 232. 1884. The latest descriptions of this part of Florida are in the Third Annual Report of the Florida State Geological Survey (January, 1911), pages 92, 96, 97, 126, 135, 136, 224, 225.

†For notes on this ridge in geographical literature see Loughridge, Tenth Census U. S. **6**: 315, 316 (last paragraph), 317, 421, 423, 424. 1884; McCallie, Geol. Surv. Ga. Bull. 8: 96 (line 26). 1902; Sellards & Gunter, Ann. Rep. Fla. Geol. Surv. **3**: 126, 136. 1911. Also Pop. Sci. Monthly **74**: 603 (near bottom), 605. 1909; Ann. Rep. Fla. Geol. Surv. **3**: 225. *pl. 16*. 1911. It was called a terrace by Loughridge, and a dune by McCallie.

‡See Bull. Torrey Club **32**: 158, 459. 1905. One of the calcareous swamps between Folkston and Jacksonville, which I first observed from the train on March 4th and examined at leisure the latter part of May, contributed largely to the habitat list on pages 241 and 242 of the Florida report just cited.

§In the long-leaf pine region a pretty sharp distinction can be made between big and little sawmills, the former being built to stay several years, and being provided with a waste burner or slab pit, a contrivance by which the slabs wasted in sawing are conveyed up a long incline and dropped into a fire which burns day and night. The small mills are more temporary affairs, and lack this conspicuous appendage.

of Jesup, Folkston, and especially Jacksonville, the vegetation of the flat pine barrens has apparently never been described except in the most vague and general terms, as it might be by a person with no knowledge of botany whatever. And Nassau County, Florida, through which I passed for 23 miles, has scarcely been visited by collectors or mentioned in botanical literature.

The following list will give the reader a pretty good idea of the prevailing trees and evergreen shrubs of the region under consideration, but of course only a very small fraction of the herbs.

TREES

72 **Pinus Elliottii**
63 **Pinus palustris**
59 Taxodium imbricarium
28 **Pinus serotina**
20 **Magnolia glauca**
19 Acer rubrum
11 Nyssa biflora
8 Quercus Catesbaei
7 **Pinus Taeda**
4 Taxodium distichum
4 **Quercus nigra**
2 **Juniperus virginiana?**
2 **Magnolia grandiflora**

SMALL TREES OR LARGE SHRUBS

21 **Cliftonia monophylla**
21 **Ilex myrtifolia**
5 Nyssa Ogeche

SHRUBS

68 **Serenoa serrulata**
29 **Ilex glabra**
20 **Smilax laurifolia**
5 **Phoradendron flavescens**
4 **Sabal glabra**
2 **Pieris nitida**

HERBS

20 **Tillandsia usneoides**
3 Aristida stricta
2 Andropogon virginicus
2 **Cladium effusum**

Besides the branch, creek, and river swamps common to most flat pine-barren regions there are two other palustrine types of vegetation, characterized by shallow stagnant water; namely, cypress ponds, with *Taxodium imbricarium* and *Pinus Elliottii* the dominant trees, and a lower story of *Ilex myrtifolia* and often *Nyssa biflora;* and bays (somewhat resembling the pocosins of eastern North Carolina), with *Pinus serotina* or sometimes *P. Elliottii* dominant and a dense undergrowth of large evergreen shrubs and vines, such as *Cliftonia* and *Smilax*. *Pinus Elliottii* and *P. serotina*, though sometimes seen together, were usually separated. Just what causes the difference in the vegetation of these two kinds of depressions is not clear, but it seems probable that the sand is deeper and the water level more constant in the bays than in the ponds; and my recent studies of Florida

peat problems have shown that the amount of seasonal fluctuation of water is of fundamental importance to aquatic vegetation, thus explaining several peculiarities of distribution which could not be satisfactorily explained in any other way.

The following notes will throw some light on the inland, coastward, northern or southern limits of certain species observed in the ten hours it took to go from Blythewood to Jacksonville.

NYSSA OGECHE Marsh. Occasional from the Altamaha River to the St. Mary's, including the swamps of both rivers. This species has long been credited to South Carolina, perhaps because it was once described by Walter (as *N. capitata*). But Walter's Flora Caroliniana contains the names of a considerable number of plants that probably do not grow within many miles of his home (which was near the center of the coastal plain of South Carolina), and a few that have not even been seen in South Carolina at all, in modern times at least; and it is reasonable to assume that he had some specimens from the two adjoining states in addition to those from his own.*

The Michauxs, father and son, and Elliott, all placed the northeastern limit of *Nyssa Ogeche* at or near the Ogeechee River in Georgia; and I do not remember seeing it even as far northeast as that, although I have crossed that river on every railroad bridge and a few wagon bridges, making over a dozen different places in all. Herbarium specimens distributed by the late Dr. J. H. Mellichamp of Bluffton, S. C., would appear to be from a tree transplanted from the Ogeechee River swamps, judging from a brief note in Garden and Forest (7: 500) for Dec. 12, 1894.

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*Among the species mentioned by Walter, which do not seem to have been seen in his neighborhood recently, if at all, the following occur to me:

Marshallia trinervia, Mesadenia sulcata (see Torreya 5: 183), *Aster carolinianus, Asclepiodora viridis* (see Ell., Sk. 1: 327. 1817), *Frasera carolinensis, Sabbatia decandra* (see Bull. Torrey Club 37: 595), *Cholisma ferruginea, Leucothoe Catesbaei, Zizia cordata, Ilex myrtifolia, Robinia hispida, Baptisia villosa* (see Coker, Torreya 11: 10), *Crataegus aestivalis, Malapoenna geniculata, Benzoin melissaefolium, Magnolia Fraseri, Nymphaea sagittifolia* (see Bull. Torrey Club 37: 598), *Trautvetteria carolinensis, Ponthieva racemosa, Cypripedium Reginae, Iris hexagona, Canna flaccida* (see Bull. Torrey Club 32: 156), *Smilax auriculata, Sabal Palmetto, Pinus glabra,* and a considerable number of strictly maritime plants. (The names used in this paragraph are the modern ones, which are different in most cases from those used by Walter. The specific names are the same as his in all but two or three cases, however.)

In another direction I have not seen this curious little tree even as far southeast as Duval County, Florida, but Mr. W. M. Canby, if there is no error about his label, collected specimens of it in March, 1869, near Hibernia in Clay County, about 20 miles south of Jacksonville.

NYSSA UNIFLORA Wang. Occasional from the Carolina side of the Savannah River swamp to about five miles northeast of Walthourville. In former years I have seen it on the Altamaha River down to within about twenty miles of the coast, but it is not known in eastern Florida at all, or anywhere near Okefinokee Swamp. It seems to grow only in swamps where the water fluctuates not less than three nor more than ten feet during the year.

ILEX MYRTIFOLIA Walt. First noticed just north of Barton, in the lower edge of Barnwell County, South Carolina. Frequent in cypress ponds the rest of the way to Jacksonville, except in the coast region between Hardeeville and Walthourville. Some of our manuals credit this to North Carolina or even to Virginia, but I have never seen it any farther north than the point just mentioned, or anywhere outside of the range of *Pinus Elliottii*.

CLIFTONIA MONOPHYLLA (Lam.) Sarg. Abundant nearly all the way through Wayne County, Georgia, between Doctortown and Nahunta, a distance of about 30 miles; but not seen elsewhere on this trip. It seems to reach its northeastern limit between the Ogeechee and Savannah rivers, where it has been observed in three different centuries, by Bartram,* Michaux,† Nuttall,‡ and myself.

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* Travels, 31. 1791.

† In the Journal of André Michaux, edited by C. S. Sargent, and published in 1889, there is the following interesting entry under date of May 19, 1787, when father and son were journeying together from Savannah to Augusta, mostly following the high ground between the Savannah and Ogeechee rivers:

"Un peu avant d'arriver à Beaver Dam [Creek] je recueillis sur la route, étant alors à 60 milles de distance d'Augusta, un Rumex arbriss. que je nommeray Lapathum occidentale, grand arbriss[eau], de 25 à 30 pieds de haut. Il se trouve aussi près de la rivière Altamaha, d'où mon fils me l'avoit apporté les jours précédents."

Prof. Sargent in a footnote here refers this "*Rumex* bush" doubtfully to *Brunnichia cirrhosa;* but the occurrence of *Brunnichia* in such a place (which was probably a few miles east of where Sylvania now is) is highly improbable, and besides, Michaux would hardly have described *Brunnichia* as a shrub. Furthermore, it does not bloom until midsummer, and in May there would have been little to suggest its affinity to *Rumex*. *Cliftonia*, however, has green fruit on it in May, and this re-

I have never found it within about 25 miles of the coast in Georgia; and like *Nyssa uniflora*, but doubtless for different reasons, it is not known to occur in eastern Florida.

CERATIOLA ERICOIDES Michx. Observed three times on the highest and driest sandhills of Lexington County, South Carolina, about halfway between Columbia and Perry, which must be near its northern limit. *Kuhnistera pinnata* and *Lupinus diffusus* were seen with or near it, and nowhere else on that day.

BAPTISIA PERFOLIATA (L.) R. Br. This most striking (and one of the least widely distributed) species of *Baptisia* was seen only once on the day indicated, namely, a little north of Kline, in Barnwell County, South Carolina.

MAGNOLIA GRANDIFLORA L. First noticed in the upper edge of Hampton County, South Carolina. This beautiful tree is evidently much rarer in South Carolina than in some of the states farther west.

MYRICA CERIFERA L. Frequent from a point a little north of Barnwell, S. C., southward.

TILLANDSIA USNEOIDES L. First seen in the swamp of the South Fork of the Edisto River on the boundary between Orangeburg and Barnwell counties, South Carolina, where it is very abundant. This characteristic coastal plain epiphyte seems to reach the fall-line only along or near the muddy rivers,* and the Edisto is not of that class.†

ORONTIUM AQUATICUM L. Seen on this trip only in the estuarine marshes of the Ogeechee River, Georgia. Throughout its

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sembles that of *Rumex* (section *Lapathum*) about as much as anything else. It is also common near the Altamaha River. Michaux's first-named locality must be very near where Bartram saw the same plant in the preceding decade.

The type locality of this species (*Ptelea monophylla* Lam.) was given as "Carolina," but that should not be taken too literally. Strange to say, it does not seem to have been mentioned, under any name, in Michaux's Flora Boreali-Americana or in his son's North American Sylva (it was afterward added to the latter by Nuttall, though); but this is true of several other plants mentioned in Michaux's journal, and probably indicates that their specimens in such cases, if they preserved any, got lost.

‡N. Am. Sylva 2: 93. 1846.

*In this connection see Nuttall's remarks on the distribution of this species, in his Genera 1: 208, 209. 1818.

†See Bull. Torrey Club 34: 257. 1907.

range its favorite habitat seems to be stagnant or gently flowing non-calcareous water whose level does not vary more than a foot or so during the year.

SERENOA SERRULATA (Michx.) B. & H. First seen in Chatham County, Georgia, about six miles beyond where the Savannah River was crossed. It is reported from South Carolina, but in that state is perhaps confined to the southernmost county, Beaufort, in which I have never been.

SABAL PALMETTO (Walt.) R. & S. Seen only in the marshes of the Little Ogeechee River, Chatham County, Georgia. The rest of the way I was evidently too far inland for it.

SABAL GLABRA (Mill.) Sarg. First noticed in the Savannah River bottoms near Hardeeville, S. C.

CLADIUM EFFUSUM (Sw.) Torr. Seen only between Callahan and Jacksonville, Florida, in a few shallow swamps where limestone is assumed to be near the surface. In other states it seems to be almost confined to estuarine marshes near the coast, but in Florida it grows in nearly every county.

TAXODIUM. Both species were first encountered this time in Barnwell County, South Carolina, *T. imbricarium* in the northern edge of the county, and *T. distichum* just south of the county seat. Both extend far down into Florida.*

CHAMAECYPARIS THYOIDES (L.) B.S.P. Noticed twice along creeks in the sandhills of Lexington County, South Carolina, about ten miles southwest of Columbia.

JUNIPERUS. Whether the *Juniperus* which is indigenous near the southern coast is *J. virginiana* or *J. barbadensis*, or both, I have never been able to determine. Trees of this genus were seen in the Little Ogeechee marshes, Chatham County, Georgia, and in two supposedly calcareous swamps between Callahan and Jacksonville, Florida. (I afterwards collected specimens at the locality nearest Jacksonville.) It is decidedly rare in eastern Florida.

PINUS GLABRA Walt. Seen first in the upper edge of Hampton County, South Carolina, and last just north of the Ogeechee River in Georgia. Farther south the boundary of its range seems to diverge considerably from the coast.

*See Ann. Rep. Fla. Geol. Surv. 3: 352, 353. 1911.

PINUS ELLIOTTII Engelm. First seen about a mile north of Allendale, S. C., which is pretty close to the place where I last saw it on my way northward in 1909, which may safely be taken as its northern limit.*

UNIVERSITY, ALA.

*See Bull. Torrey Club **37**: 603. 1911.

List of plants collected above timber line on Pikes Peak, with altitudinal extensions and notes

BLANCHE SOTH

Experts might be able to differentiate a few other varieties and species of grasses and sedges in addition to the conspicuous ones given in the following list of plants collected above the timber line on Pikes Peak; otherwise this list is exhaustive and my determinations have been corrected and verified by the submission of doubtful specimens to Dr. P. A. Rydberg and Dr. Aven Nelson, both of whom have been most kind in this respect as well as in giving me information upon doubtful points. They have my sincere thanks for their interest and assistance.

1. ACHILLEA LANULOSA Nutt.
2. ACONITUM COLUMBIANUM Nutt.
3. ADOXA MOSCHATALINA L.
4. AGOSERIS AURANTIACA (Hook.) Greene
   (*Troximon aurantiacum* Hook.)
5. AGROPYRUM SCRIBNERI Vasey
6. ALLIUM PIKEANUM Rydb.
7. ALSINOPSIS OBTUSILOBA Rydb.
   (*Arenaria sajanensis* Willd.)
8. ALSINOPSIS PROPINQUA Rydb.
9. ANDROSACE CARINATA Torr.
10. ANDROSACE SUBUMBELLATA (A. Nels.) Small
11. ANGELICA GRAYI C. & R.
12. ANTENNARIA APRICA Greene
13. ANTENNARIA MEDIA Greene
14. ANTENNARIA MICROPHYLLA Rydb.
15. ANTENNARIA NARDINA Greene
16. ANTENNARIA ROSEA (Eat.) Greene
17. AQUILEGIA COERULEA James
18. AQUILEGIA SAXIMONTANA Rydb.
19. ARABIS DRUMMONDII A. Gray
20. ARENARIA FENDLERI A. Gray
21. ARTEMISIA PATTERSONII A. Gray
22. ARTEMISIA SCOPULORUM A. Gray
23. BISTORTA BISTORTOIDES (Pursh) Small
24. BISTORTA VIVIPARA (L.) S. F. Gray
25. *Boykinia Jamesii* (Torr.) Engler [TELESONIX JAMESII (Torr.) Raf.]
26. CALAMAGROSTIS PURPURASCENS R. Br.
27. CALTHA LEPTOSEPALA Hook.
28. CAMPANULA ROTUNDIFOLIA L.
29. CAMPANULA UNIFLORA L.
30. CARDUUS SCOPULORUM Greene
31. CAREX ALPINA Sw.
32. CAREX CAPILLARIS L.
33. CAREX CHALCIOLEPIS Holm
34. CAREX EBENEA Rydb.
35. CAREX FESTIVA Dewey
36. CAREX MELANOCEPHALA Turcz.
37. CAREX PETASATA Dewey
38. CAREX RUPESTRIS All.
39. CAREX SCOPULORUM Holm
40. CASTILLEJA LANCIFOLIA Rydb.
41. CASTILLEJA OCCIDENTALIS Torr.
42. CASTILLEJA SULPHUREA Rydb.
43. CERASTIUM BEERINGIANUM C. & S.
44. CERASTIUM OREOPHILUM Greene
45. CHAMAENERION ANGUSTIFOLIUM (L.) Scop.
46. CHIONOPHILA JAMESII Benth.
47. CHONDROPHYLLA AMERICANA (Engelm.) A. Nels.
48. CLAYTONIA MEGARRHIZA (A. Gray) Parry
49. CLEMENTSIA RHODANTHA (A. Gray) Rose
50. CONIOSELINUM SCOPULORUM (A. Gray) C. & R.
51. DASIPHORA FRUTICOSA (L.) Rydb.
52. *Deschampsia caespitosa alpina* Vasey [D. ALPICOLA Rydb.]
53. DODECATHEON PAUCIFLORUM (Durand) Greene

54. DRABA AUREA Wahl.
55. DRABA PARRYI Rydb.
56. DRABA STREPTOCARPA A. Gray
57. DRYAS OCTOPETALA L.

58. ELEPHANTELLA GROENLANDICA (Retz.) Rydb.
59. EPILOBIUM ANAGALLIDIFOLIUM Lam.
60. EPILOBIUM OVATIFOLIUM Rydb.
61. EPILOBIUM STRAMINEUM Rydb.
62. ERIGERON ELATIOR (A. Gray) Greene
63. ERIGERON FORMOSISSIMUS Greene
64. ERIGERON PINNATISECTUS (A. Gray) A. Nels.
65. ERIGERON SIMPLEX Greene
66. ERIGERON SMITHII Rydb.
67. ERITRICHIUM ARGENTEUM Wight
68. ERYSIMUM OBLANCEOLATUM Rydb.

69. FESTUCA BRACHYPHYLLA Schultes
70. FESTUCA OVINA INGRATA Hackel
71. FRAGARIA GLAUCA Wats.
72. FILIX FRAGILIS (L.) Und.

73. *Gentiana Parryi* Engelm.
[DASYSTEPHANA PARRYI (Engelm.) Rydb.]
74. *Gentiana plebeja* Cham.
[AMARELLA PLEBEJA (Cham.) Greene]
75. *Gentiana Romanzovii* Ledeb.
[DASYSTEPHANA ROMANZOVII (Ledeb.) Rydb.]

76. HEUCHERA HALLII A. Gray
77. HEUCHERA PARVIFOLIA Nutt.

78. JUNCOIDES PARVIFLORUM (Ehrh.) Coville
[*Luzula parviflora* (Ehrh.) Desv.]
79. JUNCOIDES SPICATUM (L.) Kuntze
[*Luzula spicata* (L.) D. C.]
80. JUNCUS CASTANEUS Smith
81. JUNCUS DRUMMONDII Mey.
82. JUNCUS TRIGLUMIS L.

83. *Lewisia pygmaea* (A. Gray) Robins.
[OREOBROMA PYGMAEA (A. Gray) Howell]
84. LLOYDIA SEROTINA (L.) Sweet
85. LYCHNIS MONTANA Wats.

86. MACHAERANTHERA ASPERA Greene
87. MERTENSIA ALPINA (Torr.) Don
88. MERTENSIA CILIATA (Torr.) Don

89. OREOCHRYSUM PARRYI (A. Gray) Rydb.
90. OREOXIS HUMILIS Raf.
91. OXYRIA DIGYNA (L.) Compt.

92. PARONYCHIA PULVINATA A. Gray
93. PEDICULARIS PARRYI A. Gray
94. PENTSTEMON HALLII A. Gray
95. PENTSTEMON GLAUCUS STENOSEPALUS A. Gray
96. PHACELIA SERICEA Hook.
97. PHLEUM ALPINUM L.
98. POA ARCTICA R. Br.
99. POA GRAYANA Vasey
100. POA PHOENICEA Rydb.
101. POA RUPICOLA Nash
102. POLEMONIUM CONFERTUM A. Gray
103. POLEMONIUM PULCHERRIMUM Hook.
104. POTENTILLA BIPINNATIFIDA Dougl.
105. POTENTILLA FILIPES Rydb.
106. POTENTILLA GLAUCOPHYLLA Lehm.
107. POTENTILLA VIRIDIOR Rydb.
108. POTENTILLA SAXIMONTANA Rydb.
109. PRIMULA ANGUSTIFOLIA Torr.
110. PRIMULA PARRYI A. Gray
111. PSEUDOCYMOPTERUS MULTIFIDUS Rydb.
112. PSEUDOCYMOPTERUS PURPUREUS (C. & R.) Rydb.

113. RANUNCULUS INAMOENUS Greene
114. RHODIOLA INTEGRIFOLIA Raf.
115. RHODIOLA POLYGAMA (Rydb.) B. & R.
116. RIBES LENTUM (Jones) C. & R.
117. RORIPA ALPINA (S. Wats.) Rydb.
118. RUBUS STRIGOSUS Michx.
119. RYDBERGIA GRANDIFLORA (Pursh) Greene

120. SALIX BRACHYCARPA Nutt.
121. SALIX SAXIMONTANA Rydb.
122. *Saxifraga austromontana* Wieg.
[LEPTASEA AUSTROMONTANA (Wieg.) Small]
123. SAXIFRAGA CERNUA L.
124. *Saxifraga chrysantha* A. Gray
[LEPTASEA CHRYSANTHA (A. Gray) Small]
125. SAXIFRAGA DEBILIS Engelm.
126. *Saxifraga flagellaris* Willd.
[LEPTASEA FLAGELLARIS (Willd.) Small]
127. *Saxifraga rhomboidea* Greene
[MICRANTHES RHOMBOIDEA (Greene) Small]
128. SEDUM STENOPETALUM Pursh
129. SENECIO ATRATUS Greene
130. SENECIO CARTHAMOIDES Greene
131. SENECIO CHLORANTHUS Greene
132. SENECIO CROCATUS Rydb.
133. SENECIO EREMOPHILUS A. Gray
134. SENECIO FENDLERI A. Gray
135. SENECIO PUDICUS Greene
136. SENECIO TARAXICOIDES A. Gray
137. SENECIO WERNERIAEFOLIUS A. Gray
138. SELAGINELLA DENSA Rydb.

139. SIBBALDIA PROCUMBENS L.
140. SIEVERSIA TURBINATA (Rydb.) Greene
141. SILENE ACAULIS L.
142. SOLIDAGO DECUMBENS Greene
143. SOPHIA INCISA (Engelm.) Greene
144. *Stellaria crassifolia* Ehrh. [ALSINE CRASSIFOLIA (Ehrh.) Britton]
145. *Stellaria umbellata* Turcz. [ALSINE BAICALENSIS Coville]
146. SWERTIA PALUSTRIS A. Nels.
147. *Synthyris alpina* A. Gray [BESSEYA ALPINA (A. Gray) Rydb.]
148. TARAXACUM DUMETORUM Greene
149. TETRANEURIS LANATA (Nutt.) Greene [*Actinella lanata* Nutt.]
150. THALICTRUM ALPINUM L.
151. THLASPI COLORADENSE Rydb.
152. TONESTUS PYGMAEUS (T. & G.) A. Nels.
153. TRIFOLIUM DASYPHYLLUM T. & G.
154. TRIFOLIUM NANUM Torr.
155. TRISETUM SUBSPICATUM (L.) Beauv.
156. VERONICA ALPINA L.
157. *Zygadenus elegans* Pursh [ANTICLEA ELEGANS (Pursh) Rydb.]

ALTITUDINAL EXTENSIONS

The first column gives the upper limit of altitude according to the Flora of Colorado, the second, the highest altitude at which I found the species on Pikes Peak.

ACHILLEA LANULOSA Nutt	12,000	12,600
ANTENNARIA MICROPHYLLA Rydb.	11,000	12,000
ANTENNARIA ROSEA (Eat.) Greene	11,000	12,000
ARABIS DRUMMONDII A. Gray	11,500	12,000
BISTORTA BISTORTOIDES (Pursh) Small	13,000	13,500
BISTORTA VIVIPARA (L.) S. F. Gray	12,000	13,000
CALTHA LEPTOSEPALA Hook.	12,000	13,000
CAMPANULA UNIFLORA L.	——	13,000
CASTILLEJA SULPHUREA Rydb.	10,000	12,000
CARDUUS SCOPULORUM Greene	12,000	13,000
CHAMAENERION ANGUSTIFOLIUM (L.) Scop.	10,000	12,600
CHONDROPHYLLA AMERICANA (Engelm.) A. Nels.	12,000	13,000
CONIOSELINUM SCOPULORUM (A. Gray) C. & R.	11,000	12,000
DASIPHORA FRUTICOSA (L.) Rydb	10,000	12,500
DODECATHEON PAUCIFLORUM (Durand) Greene	8,500	12,000
ELEPHANTELLA GROENLANDICA (Retz.) Rydb.	12,000	13,000
EPILOBIUM STRAMINEUM Rydb.	11,000	12,000
ERIGERON FORMOSISSIMUS Greene	——	12,000
ERIGERON SIMPLEX Greene	——	13,500
ERIGERON SMITHII Rydb.	10,000	12,000
ERYSIMUM OBLANCEOLATUM Rydb.	11,000	12,000
FRAGARIA GLAUCA Wats.	11,000	12,000
Gentiana plebeja Cham. [AMARELLA PLEBEJA (Cham.) Greene]	10,000	12,500
Lewisia pygmaea (A. Gray) Robins. [OREOBROMA PYGMAEA (A. Gray) Howell]	12,000	13,000
LYCHNIS MONTANA Wats.	——	12,000
MACHAERANTHERA ASPERA Greene	10,000	12,000
OREOXIS HUMILIS Raf.	13,000	14,000
PENTSTEMON GLAUCUS STENOSEPALUS A. Gray	12,000	13,000
POTENTILLA BIPINNATIFIDA Dougl.	10,000	12,000
POTENTILLA FILIPES Rydb.	10,000	12,000
POTENTILLA VIRIDIOR Rydb.	——	12,000
PSEUDOCYMOPTERUS MULTIFIDUS Rydb.	10,000	12,000
PSEUDOCYMOPTERUS PURPUREUS (C. & R.) Rydb.	11,500	12,500
RANUNCULUS INAMOENUS Greene	10,000	12,000
RORIPA ALPINA (S. Wats.) Rydb.	——	11,500

RUBUS STRIGOSUS Michx.	10,000	12,000
SALIX BRACHYCARPA Nutt.	11,000	13,000
Saxifraga rhomboidea Greene	12,000	13,000
[MICRANTHES RHOMBOIDEA (Greene) Small]		
SELAGINELLA DENSA Rydb.	7,000	12,500
SENECIO CHLORANTHUS Greene	11,000	12,000
SENECIO EREMOPHILUS A. Gray	10,000	12,000
SENECIO WERNERIAEFOLIUS A. Gray	——	11,500
SOPHIA INCISA (Engelm.) Greene	9,000	11,500
Stellaria crassifolia Ehrh.	10,000	12,000
[ALSINE CRASSIFOLIA (Ehrh.) Britton]		
TARAXACUM DUMETORUM Greene	10,000	12,000
THALICTRUM ALPINUM L.	12,000	13,000
VERONICA ALPINA L.	12,000	13,000

NOTES

The timber line on Pikes Peak occurs at an altitude of approximately 11,500 feet. While the trees extend a little higher in a few places, only those plants which were actually growing above the protection of the timber were included in this list. I collected some species which have not been thought to enter the Arctic-Alpine Zone. Some of these undoubtedly belong there while a few have spread upward from the timber line owing to favorable local environments. In general, I find two localities in which the latter plants are to be found; one is the slope on which is located the pumping station at Windy Point, and the other is the glacial amphitheater which is partly occupied by Reservoir No. 7 of the Colorado Springs water system. Both these slopes are well watered throughout the growing season and are of southerly exposure, while huge boulders and outcropping ledges give ample protection from the drying and chilling winds that sweep the more exposed portions of the peak, and also serve as obstacles to the removal of the finer and richer soil, the products of both rock and vegetable decay.

A third area of upward extension is the boggy ground along the carriage road west of the peak, where I found some hydrophilous plants at 13,000 feet, which heretofore were not supposed to grow much above the timber line.

I found no edible vegetation of any consequence. *Fragaria glauca* ripened a few small, imperfect berries on a sunny bank just above the timber, while the leaves of *Caltha leptosepala* might serve for "greens," though I found them rather leathery. The fruits of most of the plants are dry and the seeds are small

and contain little nourishment, though they are the chief food supply of the mice and rats and other rock-dwelling animals. Many species store reserve supplies in their thickened roots, from which they spring up quickly in the early summer, but I found none that were palatable or of any value for human food.

Allium pikeanum Rydb. occasionally bears pure white flowers.

Antennaria media Greene. Staminate plants of this species seem to be lacking on this peak, as diligent search in many different localities has failed to discover them.

Chamaenerion augustifolium (L.) Scop. occurs much higher than usually listed. But the colonies seem to spring up from wind-blown seed from below; they flower very late and probably never seed themselves in this zone, although the individuals may live over a winter or two.

Erigeron simplex Greene includes the small erigerons that have been referred to *E. uniflorus* L. as well as the larger forms referred to *E. leucotrichus* Rydb. I was convinced that these apparently different plants were of the same species, and inquiry of Dr. Rydberg brought me the information that *E. uniflorus* L. was not found in Colorado at all and that *E. leucotrichus* Rydb. was an unusually large form of *E. simplex* Greene, to which all these varying forms should be referred.

Gentiana plebeja Cham. [*Amarella plebeja* (Cham.) Greene] varies so as to be almost unrecognizable in some of its forms; occasionally almost white, it runs through many shades of blue and mauve to deep purple, and varies from a robust, branching plant to a single blossom flowering from the ground long after the first snows of autumn.

Lewisia pygmaea (A. Gray) Robins. [*Oreobroma pygmaea* (A. Gray) Howell] I find abundant in damp, gravelly situations rather than on dry mountain sides, as stated by some authors.

Mertensia alpina (Torr.) Don is known locally as "Pikes Peak forget-me-not." There is a rare pure white variety, the widely separated plants bearing all white clusters year after year.

Mertensia ciliata (Torr.) Don includes *M. picta* Rydb. and is the tallest plant above the timber line on Pikes Peak.

Ribes lentum (Jones) C. & R. has, in its alpine form, rosy rather than "greenish" flowers; it is quite a conspicuous plant on the edges but seldom bears fruit above the timber line.

Rhodiola integrifolia Raf. and *R. polygama* (Rydb.) B. & R. are separated with difficulty. While the extremes seem to be distinct, there are, on this mountain at least, many intermediate forms, some dioecious others polygamous, which seem to merge the two species into one. Plants that are polygamous one year may bear either staminate or pistillate heads alone the next season, and polygamous heads were found upon plants which I know bore unisexual flowers the year before.

Rubus strigosus Michx. occurs well above the timber in many places. But while it blossoms freely it rarely matures fruit on account of the early frosts and the depredations of the birds, which no doubt have brought the seeds of the existing plants up from below.

Salix brachycarpa Nutt. is the prevailing willow above the timber line, occurring as dwarfed shrubs well up toward the summit.

COLORADO SPRINGS, COLO.

New Crataegi of the northeastern manual range

W. W. Eggleston

Crataegus schizophylla sp. nov.

A small tree, perhaps 4 m. high, with ascending, irregular branches; spines numerous, 3–7 cm. long; twigs glabrous; leaves oblong-obovate to ovate, 2–6.5 cm. long, 1–4.5 cm. wide, acute or obtuse at the apex, cuneate at the base, coarsely serrate with short acute lobes towards the apex, glabrous, dark green and shining and somewhat impressed-veined above, paler beneath, coriaceous; petioles somewhat winged, 5–15 mm. long; corymbs many-flowered, glabrous, flowers about 12 mm. broad; calyx lobes lanceolate, acute, entire; stamens about 10, anthers pale pink; styles 1–3, surrounded at the base with tomentum; fruit pyriform-ellipsoidal, dark red, about 10 mm. thick; calyx persistent, the lobes reflexed; flesh hard at maturity; nutlets usually 2, ridged on the back.

E. P. Bicknell 15 (type), Job's Neck Cove, Marthas Vineyard, Massachusetts, Oct. 7, 1909. (Herbarium of the New York Botanical Garden.)

The following specimens were used in the description:

Bicknell 10, West Tisbury Road, Edgartown, Marthas Vineyard, Sep. 29, 1909.

Bicknell 12, Chappaquiddick Island, Marthas Vineyard, Sep. 30, 1909.

Bicknell 14, Sengekontacket Pond, Marthas Vineyard, Oct. 1, 1909.

Bicknell, Marthas Vineyard, June 8, 1909. (In flower.)

This species is separated from other members of the section *Crus-galli* by its broad, lobed leaves.

It ranges farther east than any of the other *Crus-galli* do naturally. It ranks with *Crataegus Jonesae* Sarg., of the Maine coast, *Crataegus Bicknellii* Eggl., from Nantucket, and *Crataegus Williamsii* Eggl., from the Flathead basin, Montana, etc., as a good example of an isolated geographical species.

In 1904 Mr. E. P. Bicknell passed over to me fruiting material of a very interesting *Crataegus*. At that time we had no flowers of this species, nor any flowering material from Nantucket, excepting a fragment collected by Miss Mary A. Day, at Wauwinet. This flowering specimen puzzled me, seeming intermediate between Mr. Bicknell's form and typical *C. chrysocarpa* Ashe (*C. rotundifolia* of the manuals). This led me to describe the Bicknell form as a variety of *rotundifolia*. Mr. Bicknell has done much exploring in Nantucket since then, and his material now leads me to consider this *Crataegus* a good species.

Crataegus Bicknellii sp. nov.

C. rotundifolia var. *Bicknellii* Eggl. Rhod. **10**: 79. 4 Je 1908.

A round-topped, shrubby tree, sometimes 3 m. high; spines stout, numerous, 2–6 cm. long; vegetative twigs glabrous; leaves ovate or oblong-ovate, 4–8 cm. long, 3–7 cm. broad, acute at the apex, broadly cuneate or rounded at the base, sharply doubly serrate with acute lobes toward the apex, dark green and shining above, glabrous; corymbs many-flowered, glabrous; flowers about 16 mm. broad; stamens about 10; anthers light purple; calyx lobes long-acuminate, laciniate; styles and nutlets usually 4 or 5; fruit globose, red, about 10 mm. thick; calyx lobes persistent, reflexed, conspicuously lobed; flesh of fruit soft at maturity.

E. P. Bicknell 1 (type), Quidnet (Polpis), Nantucket, Mass., Sep. 5, 1904. (Herbarium of the New York Botanical Garden.)

The following specimens were used in the description:

Bicknell 2, Quidnet, Sep. 5, 1904.

Bicknell 3, Quaise, Nantucket, Aug. 16, 1906.

Bicknell 4, Quaise, Nantucket, Sep. 17, 1907.

Bicknell 5, east of Rattlesnake Bank, Nantucket, June 11, 1908.

Bicknell 6, Shawkemo, Nantucket, June 4, 1909.

Bicknell 7, Quaise, Nantucket, June 9, 1909.

This species differs from *C. chrysocarpa* Ashe in its more sharply lobed leaves and calyx lobes, and its more numerous nutlets.

UREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1905–1911)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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